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 INFORMATION FROM  
 FOREIGN DOCUMENTS OR RADIO BROADCASTS

REPORT

50X1-HUM

CD NO.

COUNTRY USSR

DATE OF  
INFORMATION 1952SUBJECT Economic; Technological - Machine tools, elec-  
trical grinding  
methods

DATE DIST. 17 Aug 1953

HOW  
PUBLISHED Book

NO. OF PAGES 6

WHERE  
PUBLISHED MoscowDATE  
PUBLISHED 1952SUPPLEMENT TO  
REPORT NO.

LANGUAGE Russian

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SOURCE Reztsey, by V. Ye. Nedorezov, published by Mashgiz, pp 192-211.ELECTRICAL METHODS OF GRINDING HARD-ALLOY TOOLS IN THE USSR

Comment: The figure "3" and the Cyrillic "Z" as printed in Soviet literature are often indistinguishable. This becomes particularly confusing in identifying model numbers of machine tools. The first digit of a model will, as a rule, identify the type of machine tool. For example, the first digit of a grinding machine model number is known to be 3. However, the present source, which does make a definite distinction between "3" and "Z", uses the capital Z with Model ZA-64 grinding machine. In the "Soviet Catalog of Metal-Cutting Machine Tools," page 218, on the other hand, the number is 3A64. The capacity of the motor is identical in each machine. It is presumed that Model ZA-64 and 3A64 are one and the same machine tool.

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Series production of special machines for anode-mechanical grinding of tools is being organized at machine-tool building plants. At present, abrasive-type machine tools are being adapted for anode-mechanical grinding at certain plants.

The universal tool-grinding machine ZA-64, for example, has been remodeled and is now known as AMZ-23. The changes made in the ZA-64 are as follows:

1. The spindle for the abrasive wheel has been replaced by a spindle head.
2. The body of the spindle has been electrically insulated from the bed of the machine.
3. The driving electric motor with a power of 0.65 kilowatt and a speed of 3,000 revolutions per minute has been replaced by a 0.85-kilowatt electric motor with a speed of 945 revolutions per minute.
4. A peripheral speed of 11 meters per minute has been imparted to the grinding disk.

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5. A tank with a sedimentation chamber for the electrolyte has been installed.

6. The machine has been equipped with an electric pump, tubing, and nozzle for feeding the electrolyte to the working zone.

7. A special guard, drip pan, and deflector have been installed on the table of the machine to protect the machine and the operator from the spatter of the electrolyte.

8. A generator supplies the machine with direct current. A commutator and a panel with a rheostat have been mounted on the machine tool.

Technical Specifications of Model AMZ-23

|   |  |
|---|--|
| Maximum size of cross section of tool that can be ground        | 30 x 40 mm   |
| Diameter of grinding disk                                       | 150 mm   |
| Peripheral speed of grinding disk                               | 1,250 rpm  |
| Spindle travel in an axial direction                            | 8 mm   |
| Power and speed of driving electric motor                       | 0.85 kw<br>945 rpm   |
| Power of electric motor of generator unit                       | 2.5-3 kw   |
| Pressure of disk spring   | 0-10 kg  |
| Longitudinal table travel                                       | 400 mm   |
| Transverse table travel   | 230 mm   |
| Lift of spindle head over table                                 | 70-275 mm  |
| Voltage and amperage of direct current                          | 24-28 v<br>60-80 amp   |
| Resistance of rheostat sections for adjustment of machine tool: |  |
| Roughing  | 0.05; 0.1; 0.15<br>ohm   |
| Grinding  | 0.25; 0.50; 0.75<br>ohm  |
| Finishing   | a. 1.8; 2 ohms<br>b. 1.8; 2.0; 3.4<br>ohms (connected<br>by means of a<br>potentiometer) |
| Capacity of tank for electrolyte                                | 30 liters  |
| Discharge of electric pump                                      | 10-15 liters/min   |

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Model K-1 anode-mechanical machine, designed by P. S. Kryzhanovskiy, is intended for grinding hard-alloy tools: cutters of various types, inserted-blade (sbornyy) milling cutters, drills, counterbores, etc.

Model K-1 is exceptional for its compact design and for the convenient location of control levers and electrical measuring instruments.

Technical Specifications of Model K-1

Maximum size of tool that can be ground:

|                                       |                |
|---------------------------------------|----------------|
| Cross section of cutter               | 25 x 40 mm     |
| Diameter and length of milling cutter | 250 and 300 mm |

Main-drive motor:

|       |           |
|-------|-----------|
| Speed | 1,500 rpm |
| Power | 1.5 kw    |

Grinding disk:

|                                       |               |
|---------------------------------------|---------------|
| Diameter and width of working surface | 150 and 40 mm |
| Speed                                 | 1,350 rpm     |

Spindle:

|              |         |
|--------------|---------|
| Axial travel | 12 mm   |
| Pressure     | 1-10 kg |

|                                    |         |
|------------------------------------|---------|
| Amplitude of headstock oscillation | 0-30 mm |
|------------------------------------|---------|

|                                     |           |
|-------------------------------------|-----------|
| Capacity of tank for working liquid | 50 liters |
|-------------------------------------|-----------|

Electric drives:

|                 |           |
|-----------------|-----------|
| PM-70 ammeter   | 0-100 amp |
| PM-70 voltmeter | 0-30 v    |

Electric pump:

|           |               |
|-----------|---------------|
| Power     | 0.1 kw        |
| Discharge | 22 liters/min |

|   |                          |
|---|--------------------------|
| Dimensions of machine (length x width x height) | 1,100 x 1,100 x 1,600 mm |
|---|--------------------------|

|                   |        |
|-------------------|--------|
| Weight of machine | 800 kg |
|-------------------|--------|

The machine is supplied by a direct-current circuit through a built-in mechanical rectifier.

Series production of Model 4352 anode-mechanical machine is being organized at machine-tool building plants.

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Technical Specifications of Model 4352

Maximum size of cutters that can be ground:

|                         |            |
|-------------------------|------------|
| Cross section of cutter | 30 x 45 mm |
| Length of cutter        | 315 mm     |

Main-drive motor:

|       |           |
|-------|-----------|
| Power | 0.65 kw   |
| Speed | 2,835 rpm |

Disk:

|                          |                 |
|--------------------------|-----------------|
| Diameter                 | 180 mm          |
| Width of working surface | 45 mm           |
| Speed                    | 2,100-2,580 rpm |

Spindle:

|              |        |
|--------------|--------|
| Axial travel | 12 mm  |
| Pressure     | 1-3 kg |

|                              |       |
|------------------------------|-------|
| Cross travel of spindle head | 85 mm |
|------------------------------|-------|

|                                |         |
|--------------------------------|---------|
| Amplitude of table oscillation | 0-32 mm |
|--------------------------------|---------|

|                                     |           |
|-------------------------------------|-----------|
| Capacity of tank for working liquid | 30 liters |
|-------------------------------------|-----------|

Electric drives:

|                 |           |
|-----------------|-----------|
| PM-70 ammeter   | 0-100 amp |
| PM-70 voltmeter | 0-30 v    |

Electric pump:

|           |                  |
|-----------|------------------|
| Power     | 0.1 kw           |
| Discharge | 10-12 liters/min |

|   |                        |
|---|------------------------|
| Dimensions of machine (length x width x height) | 1,100 x 840 x 1,460 mm |
|---|------------------------|

|                   |        |
|-------------------|--------|
| Weight of machine | 350 kg |
|-------------------|--------|

The machine is supplied by a direct-current circuit through a built-in selenium rectifier.

The special feature of another anode-mechanical grinding machine identified as designed by N. A. Lebedev is that it has two universal tool-holder heads which make it possible to grind two cutters at the same time.

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The experience of one Leningrad plant has shown that the time required for grinding one hard-alloy cutter, 20 x 20 millimeters in cross section, on an abrasive-type machine tool was 25 minutes; on Model AMZ-23, 13 minutes; and on the machine of Lebedev's design, 6.5 minutes.

The first model of Lebedev's design is now being completed. Upon series production of this machine, it will be recommended as the best among anode-mechanical machines for grinding cutters.

Technical Specifications of the Machine Designed by N. A. Lebedev

|  |  |
|--|--|
| Maximum size of cutters that can be ground                     | 30 x 40 mm   |
| Flange-type driving motor:                                     |  |
| Power  | 0.85 kw  |
| Speed  | 1,400 rpm  |
| Speed of grinding disk   | 1,400 rpm  |
| Diameter of grinding disk                                      | 200 mm   |
| Peripheral speed of disk                                       | 15 m/sec   |
| Width of working surface of grinding disk                      | 40 mm  |
| Disk travel in axial direction to shaft of electric motor      | 15 mm  |
| Pressure of disk spring  | 10 kg  |
| Vertical travel of electric motor with disk                    | 110 mm   |
| Amplitude of reciprocating movement of tool-holder heads       | 0-60 mm  |
| Number of tool-holder strokes per minute                       | 87   |
| Capacity of tank for working liquid                            | 50 liters  |
| Pump for feeding working liquid:                               |  |
| Type   | P-22   |
| Discharge  | 22 m/min $\sqrt{\text{sic}}$ ; should be expressed in liters |
| Electrical measuring instruments:                              |  |
| Direct-current voltmeter                                       | 30 v   |
| Direct-current ammeter   | 100 amp  |
| Dimensions of machine (length x width x height)                | 1,100 x 750 x 1,600 mm                                       |
| Weight of machine  | 300 kg   |
| Direct-current supply from an outside source with a voltage of | 24-28 v  |

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Electric-spark grinding of hard-alloy tools has not yet achieved industrial importance. Although electric-spark units for grinding hard-alloy tools do exist, they are used very little. On the other hand, electric-spark units for recessing the face of hard-alloy tools have been used successfully.

At present, electric-contact grinding of hard-alloy tools is in the beginning stage of its development. It has many advantages over other methods of electrical grinding. First, the need for direct-current sources is eliminated because electric-contact machines are supplied by alternating current, and transformers are used for lowering the voltage. In addition, the process is carried on without the use of a liquid medium; this complicates the technological process. These machines are also outstanding for their simple design.

A great deal of research must still be conducted on the electric-contact method of grinding. At present, it can be used in preliminary grinding of hard-alloy tools and for making chip breakers on tools.

Tools ground on an electric-contact machine must be finish-ground.

Work on an electric-contact machine designed at the Leningrad Elektrik Plant showed that in the process of grinding, a crust forms on the disk which hinders the contact between the cutter and disk. As a result, a contact resistance develops; the hard-alloy bit becomes intensely heated and cracks appear on it. To prevent this from occurring, the disk must be trued regularly.

[Sketches and more details on the machines and methods described above are available in the source, at the Library of Congress.]

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